[0017] The apparatus may comprise an antenna. The antenna may be configured to allow a flow of electrons when the antenna is illuminated by electromagnetic radiation (e.g. UV, IR, visible light, microwave, radio, or X-rays). The apparatus may be configured such that the electrons are able to tunnel from the first layer of electrically conductive material through the layer of electrically insulating material to the second layer of electrically conductive material. The apparatus may be configured such that the electrons are unable to tunnel from the second layer of electrically conductive material through the layer of electrically insulating material to the first layer of electrically conductive material. The apparatus may comprise a source of electromagnetic radiation configured to illuminate the antenna with electromagnetic radiation in order to generate the flow of electrons.

[0018] The apparatus may comprise an ammeter configured to measure an electrical current formed by the tunnelling electrons.

[0019] The apparatus may be a diode. The apparatus may form part of a photodetector or a rectenna.

[0020] According to a further aspect, there is provided a device comprising any apparatus described herein. The device may be one of the following: an electronic device, a portable electronic device, a portable telecommunications device, and a module for any of the aforementioned devices. The apparatus may be considered to be the device or a module for the device.

[0021] According to a further aspect, there is provided an apparatus comprising first and second means for electrical conduction separated by a means for electrical insulation, wherein one or both of the means for electrical conduction comprise graphene, and wherein the apparatus is configured such that electrons are able to tunnel from the first means for electrical conduction through the means for electrical insulation to the second means for electrical conduction.

[0022] According to a further aspect, there is provided a method comprising: forming an apparatus from a first layer of electrically conductive material, a second layer of electrically conductive material and a layer of electrically insulating material to provide an apparatus comprising the first and second layers of electrically conductive material separated by the layer of electrically insulating material, wherein one or both layers of electrically conductive material comprise graphene, and wherein the apparatus is configured such that electrons are able to tunnel from the first layer of electrically conductive material through the layer of electrically insulating material to the second layer of electrically conductive material.

[0023] Formation of the apparatus may comprise: depositing the first layer of electrically conductive material on top of a supporting substrate; depositing the layer of electrically insulating material on top of the first layer of electrically conductive material; and depositing the second layer of electrically conductive material on top of the layer of electrically insulating material.

[0024] Formation of the apparatus may comprise: depositing the first layer of electrically conductive material on top of a first supporting substrate; depositing the layer of electrically insulating material on top of the first layer of electrically conductive material; depositing the second layer of electrically conductive material on top of a second supporting substrate; placing the first supporting substrate on top of the second supporting substrate such that the first layer of electrically conductive material is separated from the second layer of electrically conductive material by the layer of electrically insulating material; and removing the first supporting substrate.

[0025] Formation of the apparatus may comprise: depositing the first layer of electrically conductive material on top of a first supporting substrate; depositing the layer of electrically insulating material on top of the first layer of electrically conductive material; depositing the second layer of electrically conductive material on top of a second supporting substrate; placing the second supporting substrate on top of the first supporting substrate such that the first layer of electrically conductive material is separated from the second layer of electrically conductive material by the layer of electrically insulating material; and removing the second supporting substrate.

[0026] According to a further aspect, there is provided a method comprising: controlling a flow of electrical current to be in a first direction in an apparatus, the apparatus comprising first and second layers of electrically conductive material separated by a layer of electrically insulating material, wherein one or both layers of electrically conductive material comprise graphene, and wherein the apparatus is configured such that electrons are able to tunnel from the first layer of electrically conductive material through the layer of electrically insulating material to the second layer of electrically conductive material, the flow of electrical current controlled by providing a difference in voltage to the first and second layers of electrically conductive material, and/or providing a difference in work function between the first and second layers of electrically conductive material.

[0027] The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated or understood by the skilled person.

[0028] According to a further aspect, there is provided a computer program, recorded on a carrier, the computer program comprising computer code configured to perform, when run on a processor, any method described herein.

[0029] The processor may be a microprocessor, including an Application Specific Integrated Circuit (ASIC).

[0030] The present disclosure includes one or more corresponding aspects, example embodiments or features in isolation or in various combinations whether or not specifically stated (including claimed) in that combination or in isolation. Corresponding means for performing one or more of the discussed functions are also within the present disclosure.

[0031] Corresponding computer programs for implementing one or more of the methods disclosed are also within the present disclosure and encompassed by one or more of the described example embodiments.

[0032] The above summary is intended to be merely exemplary and non-limiting.

BRIEF DESCRIPTION OF THE FIGURES

[0033] A description is now given, by way of example only, with reference to the accompanying drawings, in which:

[0034] FIG. **1***a* shows a conventional MIM diode without an applied potential;

[0035] FIG. **1***b* shows an energy band diagram for the MIM diode of FIG. **1***a;*

[0036] FIG. **2***a* shows a conventional MIM diode with an applied potential;

[0037] FIG. **2***b* shows an energy band diagram for the MIM diode of FIG. **2***a;*